U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1712

The HARLEQUIN BUG AND ITS CONTROL

THE HARLEQUIN BUG is a serious pest of cabbage and related crops in the Southern States. It sucks the sap from the leaves and causes them to wilt and, if the plants are young, to die.

The pest can best be controlled by practicing clean cultural methods throughout the season, and especially by disking and plowing-under all stalks and other refuse as soon as the crop has been harvested. The growing of trap crops, hand picking, and the use of the blow torch are also effective methods of keeping down the number of bugs. Derris extract is the most efficient insecticide for use against this insect, but control by spraying is not recommended until preventive measures have been followed and unless the prices of the crops are high enough to warrant the expenditure.

A description of this insect and its habits and details as to the methods of controlling it are given in this bulletin.

This bulletin supersedes Farmers' Bulletin 1061, Harlequin Cabbage Bug and Its Control.

Washington, D.C. Issued August 1933

THE HARLEQUIN BUG AND ITS CONTROL

By W. H. WHITE, *principal entomologist, and* L. W. BRANNON, *assistant entomologist, Division of Truck Crop and Garden Insects, Bureau of Entomology* [1]

CONTENTS

THE HARLEQUIN BUG has long been a serious pest of cabbage and other crucifers in the southern part of the United States. This brilliantly colored red and black plant bug sucks the sap from the leaves and veins of the plants, causing them to wilt and wither and many of them to die. Severely injured plants appear as though they had been swept by fire, thus giving the insect the popular name "fire bug." It is also known variously as "calico back", "terrapin bug", "cabbage bug", and "collard bug", and to scientists as *Murgantia histrionica* Hahn.

DISTRIBUTION

The harlequin bug is a native of Central America and Mexico. It was first recorded in the United States in Washington County, Tex., in 1864. This appearance was followed by a rapid eastward and slower northward spread over the South, approximately the northern limits for normal damage being reached by 1870. The insect has been found as far north as southern South Dakota, southeastern Iowa, southern Wisconsin, southern Michigan, northern Ohio, northern Pennsylvania, western New York, Connecticut, and Massachusetts, but it is not a pest of economic importance in the Northern States, probably on account of adverse climatic conditions.

FOOD PLANTS

The harlequin bug is primarily a pest of crucifers and readily attacks such plants as cabbage (fig. 1), mustard, turnip, collards (fig. 2), rutabaga, broccoli, kale, cauliflower, radish, chinese cabbage,

[1] In cooperation with the Virginia Truck Experiment Station, Norfolk, Va.

183227°—33

horseradish, brussels sprouts, kohlrabi, and rape. Under extreme conditions, such as lack of normal food and heavy infestations, the pest has been known to attack squash, corn, beans, and other vegetable crops not belonging to the same plant family as cabbage. It also feeds and breeds on wild mustard, shepherds-purse, peppergrass, bittercress, rockcress, watercress, sea rocket, bee plant, and practically all other plants of the mustard family.

NATURE OF INJURY

The harlequin bug has sucking mouth parts and obtains its food by piercing and sucking the juices from the leaves and stems of the plants on which it feeds. Shortly after the feeding, white areas or

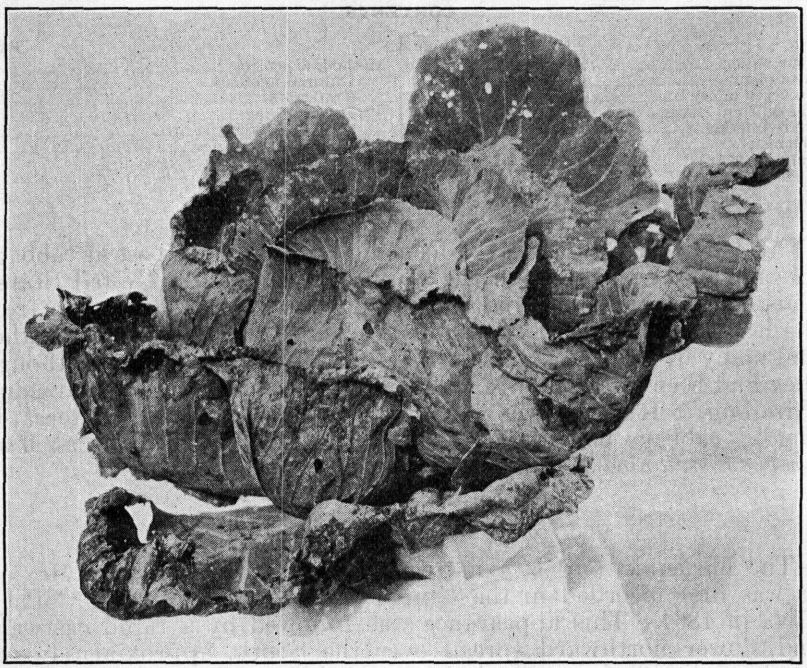

FIGURE 1.—Cabbage plant showing typical harlequin-bug injury. Some of the leaves are wilted and others show the characteristic white feeding areas.

blotches appear about the spots where the insect has punctured the plant tissue (fig. 1). When the insect is abundant and attacks young plants, they soon wilt, turn brown, and die. If larger plants are fed on, stunted growth is often the result (fig. 2).

THE DIFFERENT STAGES

The harlequin bug has a very distinctive appearance. It is brilliantly colored and strikingly marked with red or yellow and either black or deep blue. The adult is about half an inch long, flat, and shield-shaped (fig. 3, A).

The eggs are about one twenty-fifth of an inch long. They are pearl gray or pale yellow in color, with two black bands, one near

FIGURE 2.—Field of collards showing plants injured by the harlequin bug in the foreground as compared with uninjured plants in adjacent rows. Note wilting and stunting of the injured plants.

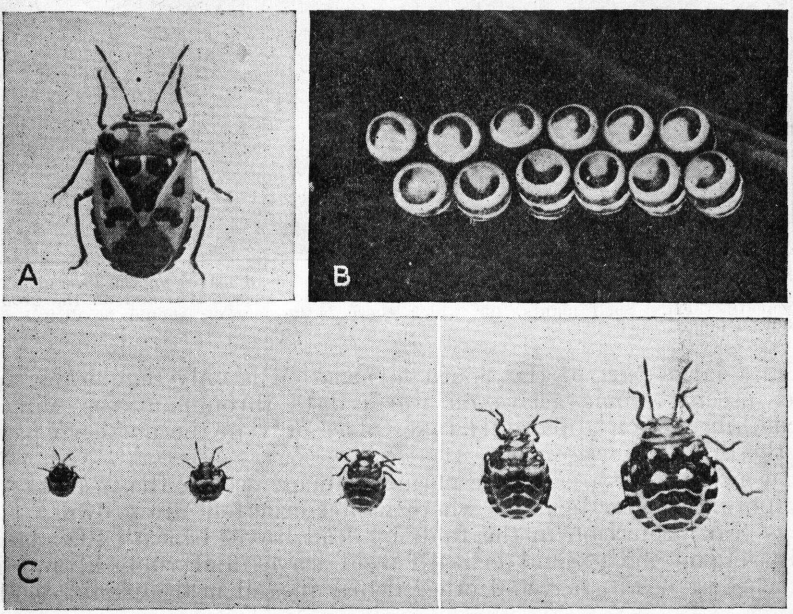

FIGURE 3.—A, Adult harlequin bug; B, eggs; C, first to fifth nymphal stages. Eggs about 9 times natural size; nymphs about 2½ times natural size; adult about twice natural size

the top and the other near the bottom, and with a small black spot just above the lower band. They have the general appearance of small black-banded barrels (fig. 3, B).

The immature stages, or nymphs, are similar to the adults in appearance, except that they are smaller and lack wings. As the young nymph grows, it molts or sheds its skin, passing through five stages before becoming full grown (fig. 3, C).

OVERWINTERING

Throughout most of its range the harlequin bug lives through the winter in the adult stage. As far north as eastern Virginia, during exceptionally mild winters, eggs, nymphs, and adults have been found in the field in February, and farther south the insect may be active during the entire winter.

FIGURE 4.—Collard plants, showing an accumulation of dead leaves on the ground. The harlequin bug seeks winter protection in the folds of such leaves and on the ground beneath them. Such plants, for which there is no market, should be disked and plowed under.

In a large part of the South hibernation is only temporary, for the insects become active on warm days throughout the winter. True hibernation apparently takes place only in the northern parts of the infested territory.

In most of the area where normal damage occurs, the insects seek temporary shelter in fields where winter crucifers are grown. The bugs seek protection in the folds of dead leaves beneath the plants (fig. 4), on the ground beneath dead leaves and rubbish, and in bunches of dead grass and other debris in and near infested fields.

LIFE HISTORY

Usually in the early spring the insects leave winter quarters, and all stages may be found in the field during the entire growing season. About 15 days after becoming active in the spring, the adult female begins depositing eggs on the lower surfaces of leaves. The eggs are deposited in double rows of from 10 to 13, 12 being the usual number. A female may lay an egg mass every 5 or 6 days. It has been observed that as many as 187 eggs have been deposited by a single female, while the average number was 115.

Eggs laid in the early spring usually hatch in 15 to 20 days. As the weather becomes warmer the eggs hatch after 4 or 5 days. After hatching, the young, or nymphs, remain congregated about the eggshells for 24 to 36 hours before beginning to feed. In the early spring the complete development from egg to adult may require between 60 and 70 days. In midsummer this period is shortened to between 40 and 60 days. The female deposits eggs within 2 or 3 weeks after becoming full grown.

Some of the individuals that overwintered may live 120 days, but the majority die after about 60 days. The bugs that overwintered usually live longer and deposit more eggs than those of the generations that develop within the active season. The egg-laying period for females that pass the winter ranges from 40 to 80 days.

In most of its range two generations and a partial third occur. Late in the fall, activity is retarded, and general feeding usually ceases by the time of the first frost.

NATURAL ENEMIES

The harlequin bug is remarkably free from parasites and predacious insects. No internal parasite of the insect has been recorded. There are three known parasites of the eggs, *Trissolcus murgantiae* Ashm., *Trissolcus podisi* Ashm., and *Ooencyrtus johnsoni* How.; but, so far as has been observed, they have never become abundant enough throughout the infested territory to serve as a natural means of control of this pest. One of these, *O. johnsoni*, however, appeared to be of considerable value in eastern Virginia during the unusually severe harlequin-bug outbreak of 1932. This parasite was first recorded in eastern Virginia in September 1931, although it had no doubt been present for some time previously. In 1932 it was reared from harlequin-bug eggs collected in the field from the first part of July to the middle of September. During the latter part of August approximately 50 percent of the eggs in some fields were parasitized. As many as three of the minute parasites have been observed to develop in one harlequin-bug egg. It is possible that under favorable conditions this parasite may prove to be highly beneficial in some parts of the South.

One predacious insect, the wheel bug (*Arilus cristatus* L.), has been recorded as feeding on young harlequin-bug nymphs, and another, the leaf-footed bug (*Leptoglossus phyllopus* L.), is recorded as destroying the adult, but these are of slight importance as a means of natural control.

METHODS OF CONTROL

For best results in the treatment of the harlequin bug, preventive measures are necessary, as this insect is exceedingly difficult to combat after it has become numerous on its host plants.

CULTURAL METHODS

The value of clean farming in insect control has long been recognized. This is especially true in connection with the harlequin bug. Crop remnants are often left in the field for some time after harvesting. This is a bad practice, as the insects continue to breed and develop is such fields and easily move over to uninfested plantings nearby. In some sections of the South growers usually leave portions of the kale, and less frequently other cruciferous crops, for the production of seed. They sow these crops during the late summer of one season and gather the seed about the middle of the following season. After gathering the seed, they frequently leave the

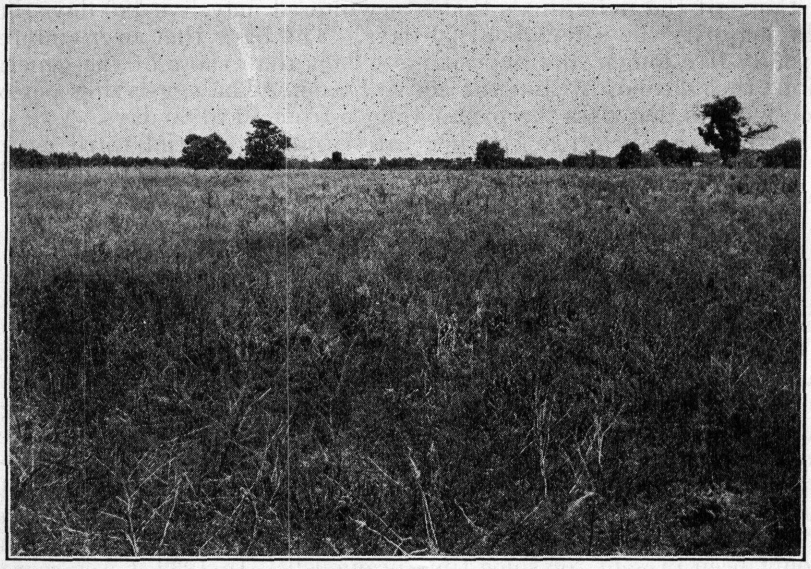

FIGURE 5.—Field of kale abandoned during the winter and left to grow up in weeds. The majority of the plants have dried up, but live sprouts are still plentiful. Large populations of harlequin bugs develop in fields such as this, and when food becomes scarce the adults fly and the nymphs crawl to young crucifers on adjacent farms.

stalks standing and desert the fields. When prices do not justify harvesting, large acreages of these crops are often abandoned during the winter and spring months, and the fields are allowed to grow up in weeds during the remainder of the season (fig. 5). These practices offer ideal conditions for the development and dispersal of the harlequin bug, as the adults that have sought temporary shelter in and near the fields during the winter remain to breed unmolested during the spring and summer. During midsummer, when food becomes scarce in such fields, the adults fly and the nymphs (or wingless forms) crawl (fig. 6) in large numbers to adjacent fields of young crucifers. Severe infestations on adjoining farms are often traced to such sources.

After a commercial crop or one grown for seed has been harvested, or when prices do not justify harvesting, all stalks, plant remains, and other refuse should immediately be disked and plowed under. In cases where cruciferous crops are left in the fields of abandoned farms, cooperative destruction by neighboring growers is highly desirable.

Crawling or migrating nymphs usually enter on one side of a field and attack the plants row by row (fig. 6). When the insects are seen massed on a few rows, its is advisable to disk and plow the heavily infested portions and thus destroy large numbers of the bugs before they are able to do serious damage. It is then important

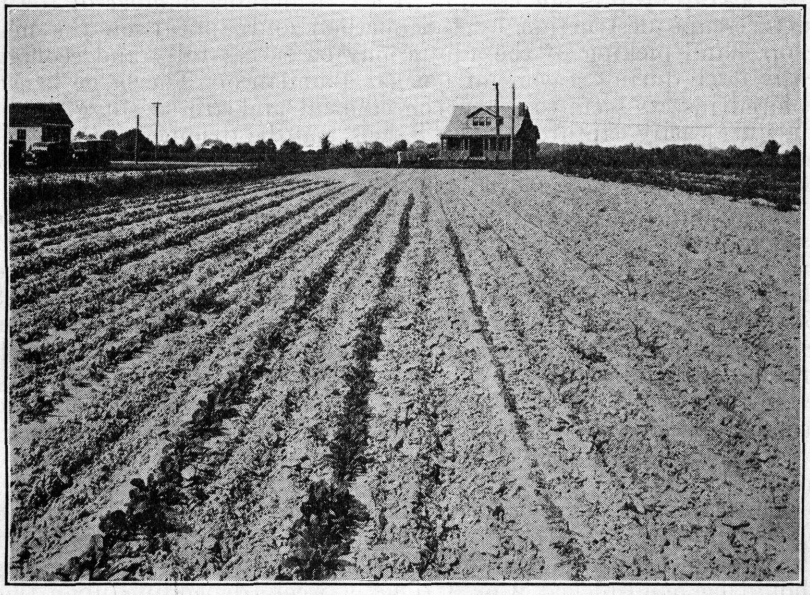

FIGURE 6.—Patch of young chinese cabbage practically destroyed by migrating harlequin-bug nymphs. The nymphs have crawled to this patch from a neighboring abandoned field of crucifers and are destroying the plants row by row.

to locate the breeding grounds (fig. 5) and destroy them in the same manner.

Wild plants of the mustard family should be carefully kept down throughout the year. A list of such plants is given on page 2.

TRAP CROPS

The growing of trap crops in harlequin-bug control has been practiced for many years. If properly handled, very good results may be obtained by this method. These crops should be planted so that they will be available to the bugs before and after the main crop, the object being to attract the overwintering forms in the spring before the main crop is available and in the fall to concentrate the bugs on a small area. In the spring such plants as mustard, rape, and kale may be utilized as trap crops. They should be planted very early in order to attract the insects from the time they become active until the egg-laying period is over.

In the fall a special trap crop may be planted if all other crops have been harvested and the fields cleaned, or a part of the main crop may be left in the field for this purpose. Since the trap crop must be destroyed to kill the insects, parts of it should be planted on different dates so that a constant food supply will be available.

Trap crops should never be used unless careful attention can be given to destroying the bugs congregated on them. If not properly handled, a trap crop will only serve as a means of breeding more of the insects and thus the purpose for which it was grown will be defeated.

HAND PICKING

If a trap crop is not used, or if a considerable number of the insects escape destruction by this method and appear on the main crop, hand picking of the adults may be successfully and economically done during seasons of normal abundance. The large bright-colored insects seem to scorn concealment and are so sluggish that they are easily captured. The insects may be dropped into buckets containing a small quantity of kerosene, or into fruit jars, from which they may be removed and burned.

An example of the ease with which this insect may be hand-picked is taken from the records at Norfolk, Va., during the spring of 1931. From April 13 to May 4 adult harlequin bugs were hand-picked daily in a 0.14-acre patch of broccoli. During this period, 1,288 bugs, or approximately 9,200 per acre, were gathered and destroyed. Since the insects tend to congregate in scattered sections of a field, individual plants were not closely examined unless one or more bugs were seen crawling about. In this case a thorough examination usually revealed the presence of additional bugs. In this manner it was possible to examine two rows at a time, and to cover an acre in about 7 hours.

Every effort should be made to stamp out an infestation before egg laying begins. The insects usually feed for about 2 weeks in the spring before depositing eggs. During this period the bugs should be hand-picked 2 or 3 times a week, depending upon their abundance, and thereafter as often as is necessary to keep the crop practically free of the pest. When bugs are found on a plant, the under surfaces of the leaves should be examined, and any eggs present should be destroyed by crushing. Any heavily infested plants on which the young, or nymphs, are found should be pulled up and destroyed.

Hand picking should be done during the warmest part of the day. At temperatures below 60° F. the activity of the insects is retarded, and many of them seek temporary shelter in the folds of dead leaves or other debris beneath the plants.

THE HAND TORCH

A plumber's blowtorch has proved to be an aid in controlling the harlequin bug. Its chief value is in destroying the insect on trap crops, although an experienced operator may safely apply it to a garden or commercial field of the more hardy cole crops such as cabbage and collards. An instant's contact with the hot flame will so injure the bugs, by scorching the legs and antennae or " feelers ", as to render them harmless and incapable of recovery. The brief contact necessary to accomplish this will not appreciably injure the plant.

In some sections growers use torches made by wrapping an old cloth about the end of a stick and then saturating the cloth in kerosene. Torches have also been made from pine knots.

CONTACT INSECTICIDES

Since the harlequin bug is a sucking instead of a chewing insect, stomach poisons have no effect upon it. In order to kill the insects a contact insecticide must be used and the bugs must be thoroughly covered with the material. This is an extremely difficult task, because the plants upon which the insects feed usually attain such a dense growth that it is practically impossible to reach the insects on all parts of the plant. In some sections of the South where turnips and mustard are sown broadcast for greens an insecticide application is impracticable.

A large number of insecticides have been tested to determine their effectiveness against the harlequin bug.[2] Several of these materials gave excellent results in cage tests, but were found to be inefficient under field conditions. The best results were obtained with derris extract (containing rotenone as the active ingredient and a spreader or wetting agent) at a dilution of 1 to 200.[3] This may be prepared as follows: Use 2 quarts of derris extract in 100 gallons of water or, in smaller quantities, 2 ounces (4 tablespoonfuls) in 3 gallons of water. Measure the quantity of derris extract required to make a given quantity of finished spray, and thoroughly dissolve this in a little water. Then add the dilute derris extract to the quantity of water needed for the finished spray. Agitate the mixture and apply immediately. Mix only sufficient spray for immediate use.

Preliminary tests indicate that commercial dusting powders containing approximately 0.5 percent of rotenone are also of value in controlling the harlequin bug.

It should be borne in mind that only those insects actually hit by the spray are killed. Thoroughness of application is of prime importance.

In treating large crucifers with a hand sprayer it is usually necessary to spray from each side of the row. After thoroughly wetting all visible bugs, it is well to direct the spray to the ground near the base of the plants, as the mechanical motion of the spray rod among the leaves often knocks a few of the insects off the plants.

Control by spraying should be resorted to only after preventive measures to reduce the numbers of the insects have been taken, and when high prices of the crops warrant the expenditure.

---

[2] Among the insecticides tested were Japanese-beetle formula sodium oleate-oleoresin of pyrethrum (made in accordance with the method given in U.S. Dept. Agr. Circ. 280, Contact Sprays for the Japanese Beetle), sodium oleate with different proportions of pyrethrum extract, pyrethrum-extract soap with 40 percent nicotine sulphate, several commercial brands of pyrethrum extract, pyrethrum extract with oils, pyrethrum extract with 40 percent nicotine sulphate pyrethrum dust, 40 percent nicotine sulphate, 40 percent nicotine sulphate with activators, nicotine tannate, 40 percent nicotine sulphate with whale-oil soap, 40 percent nicotine sulphate with oils, nicotine oleate, kerosene-nicotine oleate, nicotine-potassium oleate, sodium hydroxide and soap, several commercial brands of white and yellow soaps (with and without 40 percent nicotine sulphate) at strong dilutions, calcium cyanide dust, barium, calcium, and sodium fluosilicates as dusts and sprays, cryolite, sodium fluoaluminate), derris extract at dilutions of 1 to 200 to 1 to 1,200, derris extract at various dilutions with 0.5 percent, 1 percent, and 2 percent soap solutions, and derris extract with whale-oil soap. Derris extract was used in a small series of experiments with white-oil emulsion, summer-strength oils, and tannic acid, and with spreaders.

[3] Entomologists of the Virginia Truck Experiment Station have also obtained very good results with this spray.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE WHEN THIS PUBLICATION WAS LAST PRINTED

Secretary of Agriculture	HENRY A. WALLACE.
Assistant Secretary	REXFORD G. TUGWELL.
Director of Scientific Work	A. F. WOODS.
Director of Extension Work	C. W. WARBURTON.
Director of Personnel and Business Administration.	W. W. STOCKBERGER.
Director of Information	M. S. EISENHOWER.
Solicitor	SETH THOMAS.
Bureau of Agricultural Economics	NILS A. OLSEN, *Chief.*
Bureau of Agricultural Engineering	S. H. MCCRORY, *Chief.*
Bureau of Animal Industry	JOHN R. MOHLER, *Chief.*
Bureau of Biological Survey	PAUL G. REDINGTON, *Chief.*
Bureau of Chemistry and Soils	H. G. KNIGHT, *Chief.*
Office of Cooperative Extension Work	C. B. SMITH, *Chief.*
Bureau of Dairy Industry	O. E. REED, *Chief.*
Bureau of Entomology	C. L. MARLATT, *Chief.*
Office of Experiment Stations	JAMES T. JARDINE, *Chief.*
Food and Drug Administration	WALTER G. CAMPBELL, *Chief.*
Forest Service	R. Y. STUART, *Chief.*
Grain Futures Administration	J. W. T. DUVEL, *Chief.*
Bureau of Home Economics	LOUISE STANLEY, *Chief.*
Library	CLARIBEL R. BARNETT, *Librarian.*
Bureau of Plant Industry	WILLIAM A. TAYLOR, *Chief.*
Bureau of Plant Quarantine	LEE A. STRONG, *Chief.*
Bureau of Public Roads	THOMAS H. MCDONALD, *Chief.*
Weather Bureau	CHARLES F. MARVIN, *Chief.*

Agricultural Adjustment Administration	GEORGE N. PEEK, *Administrator.* CHAS. J. BRAND, *Coadministrator.*

U.S. GOVERNMENT PRINTING OFFICE: 1933

For sale by the Superintendent of Documents, Washington, D. C. - - - - - Price 5 cents